

Briefly, as noted in the previous response, the present invention relates to a low-pass optical filter that is utilized in an electronic imaging system to reduce aliasing or under-sampling artifacts. The filter of the present invention is a physically thin blur filter that is inexpensive and relatively simple to manufacture, yet produces a tightly controlled blur pattern that is not dependent upon polarization techniques.

Referring to the rejection of claim 3 under 35 USC 102(b) as being anticipated by Greivenkamp, Jr. '193, claim 1 requires an optical system that has a birefringent uniaxial crystal optical filter interposed in a path of incident light to produce a blurred image on the photosites, with the birefringence of the birefringent uniaxial crystal optical filter being greater than 0.05, and the birefringent uniaxial crystal optical filter being lithium niobate. Claim 2 requires that the birefringent uniaxial crystal optical filter be lithium niobate. The reference to Greivenkamp, Jr. '193 was cited to show an imaging apparatus for generating an image signal from incident light with higher spatial frequencies of the incident light limited to reduce other sampling artifacts. As noted on page 3 of the Office Action, the reference to Greivenkamp, Jr. '193 does not show a birefringent uniaxial crystal optical filter having a birefringence that is greater than 0.05 and that is made of lithium niobate as set forth in claim 1. Further, Greivenkamp, Jr. '193 does not show or suggest that the filter is made of lithium niobate as required by claim 2.

Accordingly, the reference to Greivenkamp, Jr. '193 is not believed to anticipate or make obvious the features required by claims 1 and 2.

Referring to the rejection of claims 1-2, 7, 9-12 and 15 under 35 USC 103(a) as being unpatentable over Greivenkamp, Jr. '193 and Fukushima '420, with regard to claims 1 and 2, as set forth above, the reference to Greivenkamp, Jr. '193 does not show or suggest a birefringent uniaxial crystal optical filter birefringence being greater than 0.05, or the birefringent uniaxial crystal optical filter being lithium niobate.

With respect to the reference to Fukushima '420, this reference was cited to show an optical filter that is formed of birefringent crystal. However, applicants note that the reference to Fukushima '420 does not disclose an anti-aliasing filter, a spatial filter or a low-pass filter as in CCD cameras. Fukushima '420 is concerned with wavelengths, i.e., spectral filtering by means of polarization components such as double refractors, i.e. crystal optics.

Also, in the present invention, the filters are passive, fixed in time and unchangeable. Fukushima '420 refers to a dynamic, variable compensation via a heater or cooler (see element 18 of Fig. 3 or element 36 of Fig. 5 of Fukushima '420) or piezo devices. In the present invention, the application, the

problem solved, the functionality and the field of use of the filters are different than that disclosed in Fukushima '420. The use of lithium for spectral filtering is different than the use of lithium for anti-aliasing filterings in CCD cameras. Also, Fukushima '420 mentions lithium niobate in regards to the embodiment of Figs. 3 and 4. This embodiment utilizes two wedges with the crystal axis parallel to the input facets which is structurally different from the disclosed invention which includes plane parallel plates, with a crystal axis at an angle to input facets. There is no showing or suggestion in the applied references of a lithium plane parallel plate with a crystal axis at an angle to input facets.

Therefore, even if combinable, Greivenkamp, Jr. '193 and Fukushima '420 would not show or suggest an imaging apparatus as required by claims 1 and 2, which includes an optical section having a birefringent uniaxial crystal that is lithium niobate.

Claim 7 and 9-11 depend from claim 1 and set forth further unique features of the present invention which are also not believed to be shown or suggested in the applied references. For example, claim 7 requires that the optical filter be comprised of a first plate and a second plate of lithium niobate. Applicants note that in Fukushima '420, lithium is disclosed with regard to a spectral filter used in fiber communication with a variable retardation. The structure of Fukushima et al. '420 is different than the disclosed invention since Fukushima '420 utilizes wedges as opposed to plane parallel plates.

Regarding claim 9, this claim requires that the thickness of the first plate be not equal to the thickness of the second plate. Fukushima '420 shows three filter units 103, 104 and 105. Each of the units of Fukushima '420 is made of three elements and are structurally different from the claimed invention.

Independent claim 12 requires an optical section having an optical filter made of a highly birefringent uniaxial crystal selected from a group comprised of lithium niobate, lithium tantalate, and calcite interposed in the path of the incident image light so as to produce at least four spots at a detector plane.

As discussed above, the reference to Greivenkamp, Jr. '193 does not show or suggest the combination of an optical filter which is comprised of at least lithium niobate as discussed above. Fukushima '420 does not correct the deficiencies of Greivenkamp, Jr. '193, in that the filter disclosed in Fukushima is not an anti-aliasing filter. As discussed above, Fukushima '420 discloses a spectral filtering. Therefore, even if combinable, Greivenkamp, Jr. '193 and Fukushima '420 would not show or suggest the features of claim 12. Additionally, absent applicants' disclosure, one having ordinary skill in the art would not have combined the above-noted references to achieve the claimed

invention, since neither reference discloses the combination of a filter made of lithium niobate as discussed above.

Claim 15 which depends from intermediate claim 7 which depends from claim 1, sets forth further features of the present invention with respect to the second plate comprising a plane that is tilted at a 45° angle to a plane of the first plate.

Accordingly, Greivenkamp, Jr. '193 and Fukushima '420, whether considered individually or in combination, are not believed to anticipate or make obvious the specific features required by claims 1-2, 7, 9-12 and 15.

Referring to the rejection of claim 4 under 35 USC 103(a) as being unpatentable over Greivenkamp, Jr. '193 and Fukushima et al. '399, claim 4 requires an optical section having a birefringent uniaxial crystal optical filter interposed in a path of incident light to produce a blurred image on photosites, with the birefringent uniaxial crystal optical filter being Lithium Tantalate. As noted in the Office Action, Greivenkamp, Jr. '193 fails to disclose the birefringent uniaxial crystal optical filter being Lithium Tantalate. The reference to Fukushima et al. '399 was cited to show the use of Lithium Tantalate. However, Fukushima et al. '399 relates to a tunable spectral filtering utilizing wedges, which is not like the passive spatial filter using parallel plates as in the present invention. Therefore, even if combinable, the references would not show or suggest the combination of the present invention in which a birefringent uniaxial optical filter is made of Lithium Tantalate as required by claim 4.

Accordingly, Greivenkamp, Jr. '193 and Fukushima et al. '399, whether considered individually or in combination, are not believed to anticipate or make obvious the specific features required by claim 4.

Referring to the rejection of claims 5 and 14 under 35 USC 103(a) as being unpatentable over Greivenkamp, Jr. '193 and Fukushima '420 further in view of Takatori et al. '085, claim 5 which depends from claim 1 requires that an angle between an optical axis of the optical filter and a line normal to a filter facet be 37.85°. Claim 14 requires an optical section which includes an optical filter made of lithium niobate. Claim 14 further requires that an optical axis of the lithium niobate be at an angle of approximately 37.85° from a filter facet.

As noted above, both the references to Greivenkamp, Jr. '193 and Fukushima '420 fail to show or suggest the specific features of the present invention with respect to lithium niobate. Takatori et al. '085 fails to correct the deficiencies of Greivenkamp, Jr. '193 and Fukushima '420. That is, the reference to Takatori et al. '085 does not show or suggest the specific combination of having the angle noted above and lithium niobate. The use of lithium niobate provides

for the use of thinner filters which is not shown or suggested in the applied references.

Accordingly, Greivenkamp, Jr. '193, Fukushima '420 and Takatori et al. '085, whether considered individually or in combination, are not believed to anticipate or make obvious the specific features required by claims 5 and 14.

Referring to the rejection of claim 6 under 35 USC 103(a) as being unpatentable over Greivenkamp, Jr. '193 and Fukushima '420, further in view of Penunuri '419, the references to Greivenkamp, Jr. '193 and Fukushima '420, and their applicability to the claimed invention have been discussed above. Claim 6 which depends from claim 1 requires that the optical filter be cut from a boule so that a crystal axis is at 37.85° to a boule axis of symmetry. The applied references, including Penunuri '419, are not believed to show or suggest the combination of the crystal being made of lithium niobate as set forth in claim 1, further having the angle required by claim 6.

Accordingly, Greivenkamp, Jr. '193, Fukushima '420 and Penunuri '419, whether considered individually or in combination, are not believed to anticipate or make obvious the specific features required by claim 6.

Referring to the rejection of claim 8 under 35 USC 103(a) as being unpatentable over Greivenkamp, Jr. '193 and Fukushima '420, further in view of Watanabe et al. '734; and the rejection of claim 13 under 35 USC 103(a) as being unpatentable over Greivenkamp, Jr. '193 and Fukushima '399, further in view of Watanabe et al. '734, the reference to Watanabe et al. '734 does not correct the deficiencies of the previously discussed references. Claim 8 which depends from claim 7 sets forth that a thickness of the first plate is equal to a thickness of the second plate. Claim 13 sets forth features of the double refractors and the rotation of the optical filter about an optical axis of the imaging apparatus, such that a base of the rhomboidal pattern forms an angle with one of two major coordinates the imaging apparatus of between 20° to 40° .

With regard to claim 8, the applied references are not believed to show or suggest the features of the present invention including the combination of lithium niobate and the optical filter being comprised of a first plate having a thickness that is equal to a thickness of a second plate.

With regard to claim 13, as noted above, this claim relates to the rotation of the filter so that a rhomboidal array of spots turns about an optical axis. The reference to Watanabe et al. '734 does not show or suggest this feature in that Watanabe et al. '734 does not rotate a filter.

Accordingly, Greivenkamp, Jr. '193, Fukushima '420 or Fukushima '399, and Watanabe et al. '734, whether considered individually or in combination,

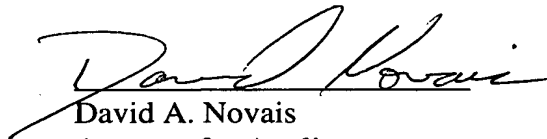
are not believed to anticipate or make obvious the features required by claim 8 and 13.

Referring to the rejection of claim 16 under 35 USC 103(a) as being unpatentable over Greivenkamp, Jr. '193 and Fukushima '420, further in view of Shoeffler et al. '284, the references to Greivenkamp, Jr. '193 and Fukushima '420, and the applicability to the claimed invention have been discussed above. The reference to Shoeffler et al. '284 does not correct the deficiencies of the previously discussed references in that this reference does not show or suggest the specific claimed combination, including the plates of the optical filter being made of lithium niobate.

Accordingly, Greivenkamp, Jr. '193, Fukushima '420 and Shoeffler et al. '284, whether considered individually or in combination, are not believed to anticipate or make obvious the specific features required by claim 1, intervening claim 7, and claim 16 which depends from claim 7.

In view of the foregoing comments, it is submitted that the inventions defined by each of claims 1-2 and 4-16 are patentable, and a favorable reconsideration of this application is therefore requested.

Respectfully submitted,



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